Beliefs, Perceptions, and Knowledge Regarding the Benefits of Nut Intake

by

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The objective of this study was to assess knowledge regarding the health effects and nutrient content of nuts and perceptions regarding benefits and barriers of nut intake among individuals over the age of 40 years. One hundred cross-sectional surveys were gathered from two sites in Greenville, NC. Eighty-five of the surveys collected met the inclusion criteria, Caucasian or African American ethnicity and above 40 years of age. The mean age of the participants was 63 and 77.6% were Caucasian, while the other 22.4% were African American.

About one-third of the participants were previously diagnosed with diabetes. Also, two-thirds of participants were previously diagnosed with some type of cardiovascular disease (CVD): heart disease (61.4%), heart attack (56.4%), angina (51.8%), and stroke (50.0%). Approximately 40% of individuals were not aware that nuts could help lower the risk for heart attacks or diabetes. Only about one-eighth of the participants were aware of the predominant fat found in nuts. Approximately 27% strongly agreed or agreed that their doctors had advised them to eat nuts most days of the week. However, 63% strongly agreed or agreed that they would consume nuts most days of the week if their doctor made these recommendations. Beliefs and perceptions were inadequate and knowledge levels were low. This indicates that current scientific evidence is not being conveyed to individuals with or at risk of CVD and/or diabetes.

Education regarding health benefits of nuts provided by doctors and other healthcare professionals could help reduce CVD and/or diabetes incidences and mortalities.

Beliefs, Perceptions, and Knowledge Regarding the Benefits of Nut Intake

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by

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LIST OF ABBREVIATIONS

American Heart Association	AHA
Body mass index	BMI
C-reactive protein	CRP
Cardiovascular disease	CVD
Center of Disease Control Behavioral Risk Factor Surveillance System	CDC BRFSS
Cholesterol and Recurrent Events Study	CARE
Coronary heart disease	CHD
European Prospective Investigation into Cancer and Nutrition	EPIC
High-density lipoprotein	HDL
Intercellular adhesion molecule-1	ICAM-1
Interleukin-6	IL-6
International Tree Nut Council Nutrition Research and Education Foundation	INC NREF
Low-density lipoprotein	LDL
Monounsaturated fatty acid	MUFA
Multi-Ethnic Study of Atherosclerosis	MESA
Myocardial infarction	MI
Polyunsaturated fatty acid	PUFA
Saturated fatty acid	SFA
Seguimiento Universidad de Navarra	SUN
Total cholesterol	TC
Triglyceride	TG
U.S. Food and Drug Administration	FDA

Women, infant and children WIC

CHAPTER 1: REVIEW OF SCIENTIFIC LITERATURE

Introduction

Cardiovascular disease (CVD), a disease of the heart and blood vessels, is the leading cause of mortality in the United States (Albert, Gaziano, Willett & Manson, 2002; What is cardiovascular disease, 2011). The risk for developing CVD increases with age. Females have higher mortality rates due to CVD than males; CVD claimed about 51.8% of female lives in 2007. Mortality rates from CVD have decreased by 27.8% from 1997 to 2007, due in part to medical developments; yet the burden of CVD still remains high. In the United States, heart disease accounted for 831,804 (33.6% of total deaths) deaths in 2007 and approximately 82,600,000 individuals have at least one type of CVD (Rogers et al., 2011).

Association of Nut Intake with Cardiovascular Disease

In 1992, Fraser, Sabaté, Beeson, and Strahan published the first study reporting reduced risk for coronary heart disease (CHD) related to frequent nut intake. Since then, more than 200 studies, including large prospective studies as well as many interventional studies, have been published reporting a beneficial impact of nut consumption on many chronic diseases. Most of these studies have dealt with risk factors for CVD; such as cholesterol level, blood lipid level, and inflammation. This beneficial impact of nuts on CVD is likely due to the nutritional profile of nuts.

Nut Consumption

Tree nuts are defined as a dried fruit with hardened ovarian walls when matured and contain a single seed. Different types of common tree nuts are almonds, hazelnuts, walnuts, pecans, macadamia nuts, pistachios, pine nuts, cashews, chestnuts, coconuts, and Brazil nuts (USDA, n.d.; Ros, 2010). Peanuts are botanically classified as legumes; yet are commonly

categorized in the nut food group by consumers (Ros, 2010). For the purpose of this study, peanuts will be categorized by the consumer classification. Nut intake has been increasing over the years. In the 1980-1981 season, 1.82 pounds of nuts were consumed per capita in the United States. However, during the 2009-2010 season, 3.69 pounds of nuts were ingested per person, as shown in Table 1 (USDA, n.d.). This is significantly low in comparison to the current nut intake recommendation of 1.5 ounces (24 pounds) (FDA, 2009). It is unclear whether this increase in nut consumption is due to the growing number of studies that have uncovered the benefits from nut consumption.

Table 1. 2009-2010 nut consumption per capita

Nuts	1980-1981	2009-2010
Almonds	0.42	1.40
Hazelnuts	0.05	0.05
Pecans	0.43	0.45
Walnuts	0.50	0.55
Macadamias	0.07	0.10
Pistachios	0.05	0.18
Brazil Nuts, Pine Nuts, Chestnuts, Cashews, & Mixed Nuts	0.32	0.96
Total	1.82	3.69

(USDA, n.d.)

Nutritional Profile of Nuts

Nuts are a nutrient dense food (Ros, 2010). Most nuts are a good source of protein, monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA). They are also relatively low in saturated fatty acids (SFA) and contain no trans fatty acids or cholesterol (Chisholm, McAuley, Mann, Williams, & Skeaff, 2005; Ros 2010). The exception includes chestnuts that contain very little fat and coconuts that contain mainly SFA. The consumption of

nuts can be used to replace foods higher in SFA, while at the same time provide beneficial MUFA and PUFA; which is consistent with the 2010 Dietary Guidelines for Americans (Dietary guidelines for Americans 2010, 2010; Griel et al., 2008). The fat content of nuts is listed in Table 2. Nuts also contain other nutrients and non-nutrient compounds that can help reduce the risk of CVD. Such compounds include antioxidants such as vitamin E and selenium, minerals such as magnesium, and amino acids such as L-arginine. Nuts also contain phytochemicals such as phenolic compounds, plant sterol and plant stenols (Jenkins et al., 2008; Ros, 2010).

Table 2. Fat content of nuts per 100 g

Nuts	SFA (g)	MUFA (g)	PUFA (g)
Almonds	3.7	30.9	12.1
Brazil Nuts	15.1	24.5	20.6
Cashews	7.8	23.8	7.8
Hazelnuts	4.5	45.7	7.9
Macadamia Nuts	12.1	58.9	1.5
Peanuts	6.8	24.4	15.6
Pecans	6.2	40.8	21.6
Pine Nuts	4.9	18.8	34.1
Pistachios	5.6	23.8	13.7
Walnuts	6.1	8.9	47.2

US Department of Agriculture Nutrient Database, n.d.

Prospective Studies on Benefits of Nut Intake

Fraser et al. (1992) evaluated the association of food consumption and chronic diseases, which included nut intake and CHD. This cohort study included 31,208 non-Hispanic white, Seventh-Day Adventists from California, with a mean age of 52 years. Researchers found a decrease of 48% in definite non-fatal myocardial infarction (MI) and 38% decrease in definite

fatal CHD in individuals who consumed nuts more than five times a week in comparison to those with an intake of less than once a week. Lower rates of definite non-fatal MI and definite fatal CHD were also seen in individuals who consumed wheat bread in comparison to white bread. However, the consumption of beef at least three times a week had a positive correlation in definite fatal CHD for both males and females, and a positive association in definite non-fatal MI for only males (Fraser et al., 1992).

Kushi et al. (1996) conducted a cohort study on 34,486 postmenopausal women, aged 55-69 years. The women had not been previously diagnosed with CVD and results were used to determine whether dietary antioxidant intake influenced CHD mortality. Adjustments for age, total energy intake, body mass index (BMI), waist-to-hip ratio, smoking, history of diabetes and hypertension, oral-contraceptive use, estrogen-replacement therapy, physical activity, alcohol intake, marital status, and education level were made. After adjustments were made, women who consumed nuts more than four times a week had a reduction of 40% in CHD death risk when compared to women who did not consume nuts. When vitamin E was ingested through food consumption only, not supplementation, a decrease in CHD death risk was seen (Kushi et al., 1996).

Hu et al. (1998) studied the association between nut intake and CHD risk in 86,016 women from the Nurses' Health Study. The age of these women ranged from 34 to 59 years. At baseline, only 102 individuals who consumed nuts more than five days a week reported having diabetes, compared to 747 individuals who never consumed nuts. Researchers found a 39% decrease in fatal CHD risk, 32% risk decrease in non-fatal MI, 35% decrease in total CHD risk, and a 57% risk decrease in diabetes in women who consumed one ounce of nuts more than five times a week in comparison to those who consumed one ounce of nuts less than once a month.

These results were apparent after adjustments for age, smoking, and other known risk factors for CHD were made. Similar results were seen when smoking, alcohol intake, multivitamin use, vitamin E supplementation, BMI, physical activity and intake of fruits and vegetables were adjusted (Hu et al., 1998).

The Cholesterol and Recurrent Events Study (CARE) was conducted to look at the relationship between nuts and reoccurring CHD events. The study included 3,575 hypercholesterolemic individuals, aged 21-75 years, who had previously experienced non-fatal MI. When nuts were consumed more than once a week, in comparison to less than once a month, there was a 25% reduction in total CHD risk. These results were seen when age, smoking, and other known CHD risk factors were adjusted. Adjustments for SFA, fiber, fruits, vegetables, minerals, and antioxidants did not significantly change the results (Kelly & Sabaté, 2006).

Albert et al. (2002) evaluated the effects of nuts on CHD among 21,454 male physicians, 40-84 years of age. When calculating the results, adjustments for age, aspirin, beta carotene treatment assignment, CVD evidence 12 months prior to questionnaire, BMI, smoking, history of diabetes, history of hypertension or high blood pressure, alcohol intake, physical activity, vitamin E or C supplementation, and multivitamin use were made. Also, dietary adjustments for fish, red meat, fruit, vegetable, and diary intake were made. Researchers found that males who consumed nuts more than twice a week had a 30% decrease in fatal CHD risk when compared to those who consume nuts less than once a month. A negative association was also seen in sudden cardiac death risk, but was not seen in non-fatal MI risk. A 16% risk reduction in sudden cardiac death occurred in males who consumed nuts more than twice a month in comparison to less than

once a month. A risk reduction of 40% in sudden cardiac death when nuts were consumed once a week and a 47% risk reduction when nuts were consumed more than twice a week when compared to less than once a week (Albert et al., 2002).

Jiang and colleagues (2002) conducted the first large prospective cohort study on the association between nut intake and the risk of developing type 2 diabetes. The study consisted of 18,818 women from the Nurse's Health Study, aged 34-59 years. During the study, 3,206 new cases of diabetes were recorded. There was strong evidence that the consumption of nuts and peanut butter were inversely associated with the risk of type 2 diabetes. The nut consumption multivariate relative risk decreased by 27% when nuts were consumed more than five times a week and decreased by 21% when peanut butter was consumed more than five times a week, in comparison to never/almost never. This relationship was seen after adjustments for age, BMI, history of diabetes, physical activity, alcohol intake, smoking, and total energy intake (Jiang et al., 2002).

Djoussé, Rudich and Gaziano (2008) evaluated the relationship between heart failure and nut consumption in lean and overweight/obese individuals. The study was conducted on 20,976 males who took part in the Physicians' Health Study I, with a mean age of 54.6 years. When compared to participants with no intake of nuts, the multivariate adjusted hazard ratio for nut intake of less than once a week was 0.98, 1.06 for intake of once a week, and 1.01 for intake of more than two times a week. Adjustments for age, smoking, BMI, heart disease, history of diabetes or hypertension, history of high blood pressure, alcohol consumption, multivitamin use fruit and vegetable intake, and exercise were made. Once these adjustments were made, there was no direct association between heart failure and nut consumption in overweight/obese or lean individuals (Djoussé, Rudich & Gaziano; 2008)

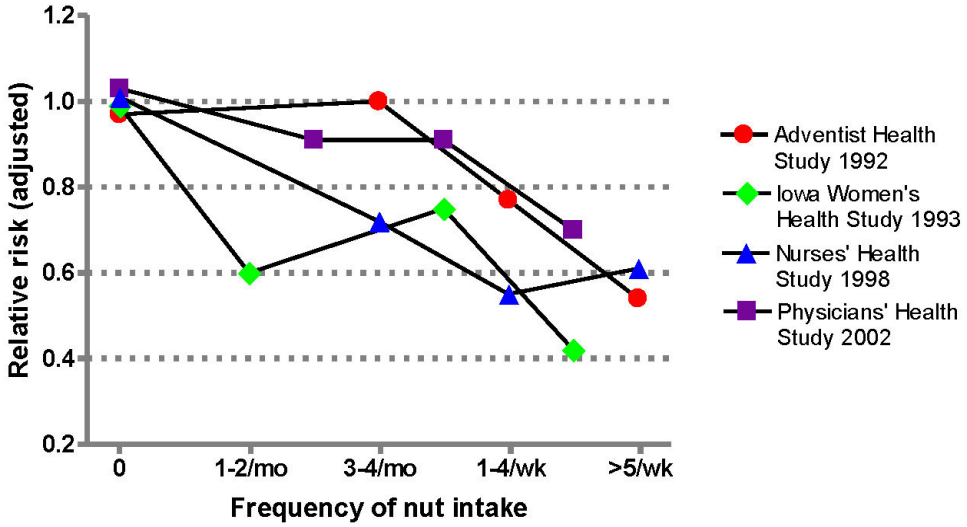
Villegas and colleagues (2008) evaluated the association between soy food and total legumes (peanuts, lentils, beans, peas, and soybeans) consumption with self-reported type 2 diabetes. This prospective cohort study examined 64,227 middle-aged Chinese women. There was a 38% decrease in the multivariate relative risk for type 2 diabetes when 3.1 g/day of total legumes were consumed when compared to the consumption of 0.1 g/day of total legumes. An inverse association was seen between type 2 diabetes incidences and legume consumption in pre- and postmenopausal women when age, BMI, waist-to-hip ratio, total energy, fiber, vegetable intake, income level, education level, physical activity, smoking, history of hypertension, and occupation adjustments were made (Villegas et al., 2008).

Djoussé and colleagues (2009) assessed the impact of nut intake on hypertension risk among 15,966 participants from the Physicians' Health Study I. The participants had a mean age of 52.3 years that ranged from 40.7-87.1. Participants were not previously diagnosed with hypertension. Nut consumption was more prevalent in individuals who drank coffee, took a multivitamin, and consumed fish, red meat, diary, and breakfast cereal. The adjustments for age, BMI, smoking, alcohol intake, breakfast cereal consumption, red meat intake, fish intake, dairy consumption, exercise, fruit and vegetable intake, multivitamin use, treatment assignment, and history of diabetes, high blood pressure or high cholesterol were made. The multivariable adjusted hazard ratio for hypertension was decreased by 3%, 2%, 4%, and 18% when nuts were consumed one to two times a month, once a week, two to six times a week, and more than seven times a week, respectively, when compared to no intake of nuts (Djoussé, Rudich & Gaziano; 2009).

The prospective studies reviewed above, with one exception, revealed consistent results that frequent nut consumption has been associated with a decrease in CVD and type 2 diabetes

(Fraser et al., 1992; Kushi et al., 1996; Hu et al., 1998; Kelly & Sabaté, 2006; Albert et al., 2002; Djoussé et al., 2008; Djoussé et al., 2009; Jiang et al., 2002; Villegas et al., 2008). A graphical summary of the impact of nuts on the risk of CHD death of four major prospective studies can be seen below in Figure 1.

Figure 1. Nut consumption and risk of CHD death in prospective studies



Adopted from: Ros, 2010

In 2002, The International Tree Nut Council Nutrition Research and Education Foundation (INC NREF) asked for approval of a health claim, based on the studies described above and other studies. The INC NREF requested that the United States Food and Drug Administration (FDA) qualifies nuts (both tree nuts and peanuts) for a health claim that could be used on food labels. The FDA-approved health claim reads: "Scientific evidence suggests but does not prove that eating 1.5 ounces per day of most nuts [such as name of specific nut] as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease [See nutrition information for fat content]" (FDA, 2009; The International Tree Nut Council Nutrition Research & Education Foundation, 2003).

Effect of Nut Intake on Cardiovascular Disease Risk Factors

According to the American Heart Association (AHA), the major risk factors of CVD include high blood pressure, high serum cholesterol, BMI, diabetes mellitus and smoking. In 2003, data from the Center of Disease Control Behavioral Risk Factor Surveillance System (CDC BRFSS) survey showed that as age increased, individuals were at a greater risk of having more than two CVD risk factors (Rogers et al., 2011). Frequent intake of nuts appears to beneficially affect most dietary modifiable CVD risk factors.

Nut Intake Effect on Blood Lipids

In terms of reducing the risk for CVD, the primary beneficial effect nuts have is on altering blood lipid profiles (Chisholm et al., 2005). Banel and Hu (2009), in a meta-analysis, reviewed 13 studies that assessed changes in the blood lipid profile using walnuts as an intervention. Twelve of the studies were randomized trials and 10 had a crossover design. Between all 13 studies, 365 individuals were included. The subjects' ages ranged from 25-75 years and four of the studies consisted of only male subjects. Four studies included individuals with healthy (as defined by author, no lipid-altering medications, or PSA >2.0 ng/mL) cholesterol levels and six studies only included individuals with modest hypercholesterolemia. The other three studies looked at the effects of walnut intake on people with type 2 diabetes, older obese individuals or individuals diagnosed with a metabolic syndrome. In these studies, walnuts provided 10% and 24% of total calories. The mean decrease in total cholesterol (TC) was 10.3 mg/dL and the mean decrease in low-density lipoprotein (LDL) cholesterol was 9.2 mg/dL. There was no significant difference seen in high-density lipoprotein (HDL) cholesterol or triglyceride (TG) levels when the control and walnut diets were compared (Banel & Hu, 2009).

Chisholm et al. (2005) conducted a study to determine the impact of nut intake on blood lipids of 28 healthy men and women with a mean age of 48.3 years. Participants purchased their own nuts, which included almonds, Brazil nuts, cashews, hazelnuts, macadamia nuts, peanuts, pecans, pistachios, and walnuts. The nuts were used as part of a low SFA diet that required 30 g/day of nuts. After consuming the experimental diet for two separate, six weeks periods, researchers found a decrease from 5.96 mmol/L to 5.44 mmol/L in TC and from 4.08 mmol/L to 3.67 mmol/L in LDL cholesterol (Chisholm et al., 2005).

Griel et al. (2008) also found that TC and LDL cholesterol levels were decreased due to the unsaturated fatty acid content in nuts. This study consisted of 25 moderately, hypercholesterolemic males and females, with a mean age of 50.2 years. One and a half ounces of macadamia nuts was added to each participants' meals. The addition of nuts to the meals resulted in a decrease in TC from 5.66 mmol/L to 4.94 mmol/L (9.4%) and a decrease in LDL cholesterol from 3.68 mmol/L to 3.14 mmol/L (8.9%) (Griel et al., 2008).

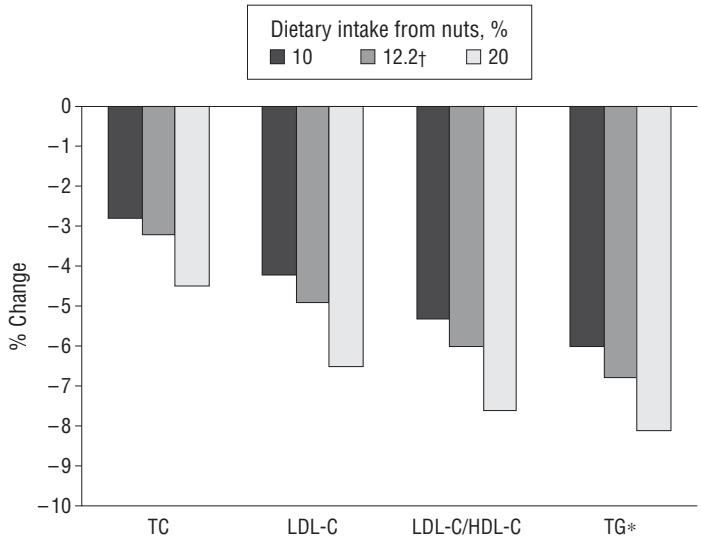
Gebauer et al. (2008) conducted a study on pistachios and their effect on cholesterol levels in 28 males and females, with a mean age of 50.9 years. Participants consumed a lower-fat diet containing no pistachios, a one serving of pistachios diet, or two servings of pistachios diet. The two servings of pistachios diet resulted in reduced LDL cholesterol by 11.6% and TC by 8%. This study was the first study to indicate an inverse relationship between pistachios and CVD risk factors (Gebauer et al., 2008).

Sabaté et al. (2010) looked at the effect of nut consumption on blood lipids by evaluating 25 interventional studies. Combined, the studies included 583 individuals from seven different countries who consumed a mean of 67 g of nuts daily. A mean decrease of 10.9 mg/dL in TC, a mean decrease of 10.2 mg/dL in LDL cholesterol, and a mean increase of 0.009 in HDL

cholesterol was seen when nuts were consumed. In individuals with TG levels greater than 150 mg/dL at baseline, a 20.6 mg/dL decrease in TG levels was seen at the end of the study (Sabaté, Oda & Ros, 2010).

The AHA estimates that a 10% decrease in TC levels could reduce CHD incidence by approximately 30% (Rogers et al., 2011). Studies, as seen in Table 3, have shown that nut consumption could be used as a therapeutic dietary intervention to reduce blood lipid levels, including TC, LDL cholesterol and TG. An increased frequency of nut consumption can result in a greater decrease in blood lipid levels, as seen above in Figure 2. A reduction in blood lipid levels can help lower CVD risk (Chisholm et al., 2005; Banel & Hu, 2009; Griel et al., 2008; Gebauer et al., 2008; Sabaté et al., 2010).

Figure 2. Effect of nut consumption on blood lipid and lipoprotein levels



Adopted from: Sabaté et al., 2010

Table 3. Change in blood lipid profiles in interventional nut studies

Source	# of Subjects (Sex) Mean Age, y	Subject Characteristic	Daily Amt of Nuts & Type, g	Duration of Dietary Intervention, wk	TC	LDL	HDL	TG
Sabaté et al., 1993, USA	N=18 (18M) Age: 30	Normocholesterolemia	79 Walnut	4	-12.4%	-16.3%	-4.9%	-8.3%
Abbey et al., 1994, Australia	N=16 (16M) Age: 41	Normocholesterolemia	84 Almond, 68 Walnut	3	-7% & -5%	-10% & -9%	No significant change	No significant change
Colquhoun et al., 1996, Australia	N=14 (7M, 7F) Age: 46	Normocholesterolemia	54 Macadamia	4	-7.9%	-10.7%	No significant change	-20.9%
Spiller et al., 1998, Canada	N=45 (12M, 33F) Age: 53	Hypercholesterolemia	100 Almond	4	-222 ± 28 mg/dL	-141 ± 25 mg/dL	No significant changes	No significant changes
Chisholm et al., 1998, New Zealand	N=16 (16M) Age: 45	Hypercholesterolemia	78 Walnut	4	-0.25 mmol/L	-0.36 mmol/L	0.15 mmol/L	0.05 mmol/L
Kris-Etherton et al., 1999, USA	N=22 (9M, 13F) Age: Unknown	Normocholesterolemia	Unknown Peanut	3.4	-10%	-14%	No significant change	-13%
Edwards et al., 1999, USA	N=10 (4M, 6F) Age: 46	Hypercholesterolemia	60 Pistachio	3	-9 mg/dL	-11 mg %	4 mg %	-6 mg/dL
Durak et al., 1999, Turkey	N=30 (18M, 12F) Age: Unknown	Normocholesterolemia	69 Hazelnut	4.3	-8 mg/dL	-14 mg/dL	3 mg/dL	19 mg/dL
Zambón et al., 2000, Spain	N=49 (26M, 23F) Age: 56	Hypercholesterolemia	46 Walnut	6	-4.1%	-5.9%	3.2%	-6.1%

Morgan & Clayshult, 2000, USA	N=19 (4M, 15F) Age: 41	Normocholesterolemia	68 Pecan	8	-0.15 mmol/L	-0.15 mmol/L	0.08 mmol/L	-0.14 mmol/L
Curb et al., 2000, USA	N=30 (15M, 15F) Age: Unknown	Normocholesterolemia	Unknown Macadamia	4.3	-0.36 mg/dL	-0.25 mg/dL	-0.05 mg/dL	-0.12 mg/dL
Rajaram et al., 2001, USA	N=23 (14M, 9F) Age: 38	Normocholesterolemia	85 Pecan	4	-6.7%	-10.4%	5.6%	-11.1%
Almario et al., 2001, USA	N=18 (5M, 13F) Age: Unknown	Normocholesterolemia	52 Walnut	6	-0.58 ± 0.16 mmol/L (HD+W diet) & -0.46 ± 0.14 mmol/L (LFD+W diet)	-33.4 ± 4.3 % (HD+W diet)	-0.13 mmol/L (HD+W diet) & -0.16 mmol/L (LFD+W diet)	No significant change
Lovejoy et al., 2002, USA	N=30 (13M, 17F) Age: 25	Normocholesterolemia						
Lovejoy et al., 2002, USA	N=20 (10M, 10F) Age: 54	Normocholesterolemia						
Jenkins et al., 2002, Canada	N=27 (15M, 12F) Age: 64	Hypercholesterolemia						
Iwamoto et al., 2002, Japan	N=40 (20M, 20F) Age: 24	Normocholesterolemia	51 Walnut	4	-4.5%	-9.8%	-1.3%	0%
Hyson et al., 2002, USA	N=22 (10M, 12F) Age: 44	Normocholesterolemia	66 Almond	6	-4%	-6%	6%	-14%

Adopted & Modified from: Sabaté et al., 2010

Nut Intake Effect on Hypertension

Hypertension is one of the leading risk factors of CVD (Rogers et al., 2011). Hypertension currently affects approximately 1 billion individuals and results in about 7.6

million pre-mature deaths worldwide (Martínez-Lapiscina et al., 2010). Diets containing nuts have shown to decrease systolic and diastolic blood pressure in men and women (Djoussé et al., 2009). Djoussé and colleagues (2009) illustrated the effects of nut consumption on hypertension in the prospective cohort study, Physicians' Health Study I, mentioned earlier.

Martínez-Lapiscina et al. (2010) conducted a cohort study, known as Seguimiento Universidad de Navarra (SUN), on 9,919 Spanish graduates to evaluate the association between nut consumption and hypertension. Individuals with prevalent hypertension prior to the study were excluded. Incidence of hypertension was prevalent in only about 12 per 1,000 persons/year. Unlike Djoussé and colleagues (2009), Martínez-Lapiscina et al. (2010) found no significant relationship between nut consumption and hypertension once adjustments for sex, age, and other dietary and non-dietary factors were made; this may be due to a small risk of hypertension in the participants within the study.

Nut Intake Effect on Inflammation

Inflammation has developed into a risk factor for CVD and can be measured through circulatory inflammatory biomarkers (Jiang et al., 2006; Ros, 2010). Plasma C-reactive protein (CRP), interleukin-6 (IL-6), fibrinogen, intercellular adhesion molecule-1 (ICAM-1) and E-selectin are some commonly measured inflammatory biomarkers (Rajaram et al., 2010; Jiang et al., 2006; Mantzoro et al., 2006). Nuts have anti-inflammatory properties, which can help reduce vascular inflammation (Jiang et al., 2006).

Rajaram et al. (2010) conducted a randomized, controlled crossover study on 25 adults, with a mean age of 40.9 years. Participants consumed one of three diets: controlled diet with no nuts (< 30% energy from fat), low-almond diet (10% isoenergetic replacement with almonds) or high-almond diet (20% isoenergetic replacement with almonds). A decrease in serum E-selectin

was seen as the consumption of almonds increased; as fat energy from almonds increased by 1%, E-selectin decreased by 0.18 μg/L. Mean CRP decreased in low and high almond diets, 53.5 g/L and 50.1 g/L respectively, when compared to the controlled diet, 54.3 g/L (Rajaram, Connell & Sabaté, 2010).

A study was conducted with 6,080 individuals with a mean age of 62.2 years (45-84 years), who participated in the Multi-Ethnic Study of Atherosclerosis (MESA). This study showed an inverse relationship between nut consumption and inflammatory biomarkers. All biomarker levels were lower when a higher frequency of nuts was consumed. The CRP level among participants who rarely/never consumed nuts was 1.98 mg/L. When participants consumed nuts less than once a week was 1.97 mg/L, one to four times a week was 1.80 mg/L, and more than five times a week was 1.72 mg/L. IL-6 levels for nut consumption of rarely/never, less than once a week, one to four times a week and more than five times a week was 343, 338, 338 and 331 mg/dL, respectively. Also, fibrinogen levels for nut consumption of rarely/never, less than once a week, one to four times a week, and more than five times a week was 1.25, 1.24, 1.21 and 1.15 pg/mL, respectively (Jiang et al., 2006).

Mantzoro (2006) conducted a study with 987 diabetic women between the ages of 30 and 55. The women had no known history of CVD and were from the Nurses' Health Study. Levels of adiponectin were measured. Adiponectin is adipose tissue with anti-inflammatory and anti-atherosclerotic properties. Women who consumed nuts had adiponectin levels 12% higher than those with a lower intake of nuts. (Mantzoro et al., 2006).

The studies reviewed above indicate an inverse association between nut intake and inflammation. The relationship can be seen through a decrease in inflammatory biomarkers such as CRP, IL-6, fibrinogen, ICAM-1 and E-selectin (Rajaram et al., 2010; Jiang et al., 2006;

Mantzoro et al., 2006). Mantzoro et al. (2006) found a positive correlation between nut intake and adiponectin; which also indicates an inverse relationship between nut consumption and inflammation.

Conclusion

Many studies have been conducted on the impact of tree nuts and peanuts on CVD and diabetes. These studies showed beneficial effects in terms of a decrease in risk for diabetes and/or CVD incidences and deaths, and also decreasing CVD risk factors such as blood lipid profile and inflammation. Existing evidence indicates that best results can be achieved when nuts are consumed frequently.

CHAPTER 2: METHODOLOGY

Study Rational

As indicated in chapter 1, nuts have a beneficial impact on the risk of CVD and/or diabetes incidences and mortalities. Although more than 200 studies on the health impact of nuts have been conducted, studies on the assessment of the perceptions of health benefits of nuts are almost nonexistent. Only two studies are currently present that have assessed beliefs, perceptions, and knowledge of health benefits concerning nut intake.

Pawlak, Colby, and Herring (2009) conducted a study on a sample of WIC (women, infant, and children) participants and found that three-fourths of participants did not believe nuts could lower the risk for heart disease or diabetes. In addition, two-thirds did not believe nuts could help lower cholesterol levels and slightly more than one-thirds believed nuts would cause weight gain. Also, the awareness among participants was low in relation to the nutrient content of nuts. Most importantly, this research concluded that WIC participants were in need of education regarding the health benefits of nut intake (Pawlak, Colby, & Herring, 2009).

Pawlak (2009) also conducted a study on the perception, knowledge, and beliefs of dietitians regarding the health benefits of nut consumption and nutrient content of nuts. Pawlak found that the majority of participants were aware of the beneficial effects nuts have on lowering heart attack risk and cholesterol levels. Many agreed that nuts were a good source of omega-3 fatty acids and disagreed they contained too much fat. Belief and perceptions were adequate and the knowledge questions were answered correctly among the majority of dietitians (Pawlak, 2009).

The awareness of the health benefits of nuts is unclear among people with or at risk for CVD and/or diabetes. It is also unknown what other perceived beliefs, barriers, or attitudes

towards eating nuts are prevalent among people in this population. Awareness, attitudes, beliefs, and perceived benefits and barriers are underlying factors for intention to engage in a behavior (Pawlak, 2003). Therefore, the goal of this research is to assess the beliefs, perceptions (e.g. attitudes and perceived barriers and benefits), knowledge, and nut consumption of individuals over the age of 40 because they are at greater risk for developing diabetes and/or CVD (Rogers et al., 2011).

Research Objectives

The specific objectives of this research and the methods to achieve them include:

Objective 1. Understand participants' beliefs concerning health benefits and nutrient content of nuts. Beliefs of participants were assessed using nine statements with three possible answers; true/agree, false/disagree and I don't know, and the percentages were calculated.

Table 4. Percentage of beliefs concerning nutrient content and health benefits of nuts

Statements	True/ Agree (%)	False/ Disagree (%)	I Don't Know (%)
Nuts are high in calories			
Nuts are high in fat			
Nuts are high in dietary fiber			
Nuts are high in salt			
Eating nuts may help to lower cholesterol level			
Eating nuts may help to lower a risk for a heart attack			
Eating nuts may help to lower a risk for diabetes			
Eating nuts will cause weight gain			
The U.S. Food and Drug Administration approved a health claim to say that eating nuts daily/on most days may lower cholesterol and prevent heart disease			

Objective 2. Measure positive and negative attitudes towards nut intake. Attitudes on nut intake were measured using ten attitudinal statements, five negative and five positive. The statements were scored on a Likert scale rated 1-strongly agree, 2-agree, 3-neither, 4-disagree, and 5-strongly disagree and the distribution was calculated.

Table 5. Distribution of statements concerning attitudes towards eating nuts on most days of a week

Positive/negative attitude statements	1 Strongly Agree (%)	2 Agree (%)	3 Neither (%)	4 Disagree (%)	5 Strongly Disagree (%)
Negative attitude					
I should not eat nuts on most days of a week because they are high in fat					
I should not eat nuts on most days of a week because they are high in salt					
I should not eat nuts on most days of a week because they would cause my cholesterol to increase					
I should not eat nuts on most days of a week because I would gain weight					
I should not eat nuts on most days of a week because nuts cause allergies					
Positive attitude					
I should eat nuts on most days of a week because nuts are healthy					
I should eat nuts on most days of a week because nuts are high in nutrients					
I should eat nuts on most days of a week because nuts are high in protein					

Positive/negative attitude statements	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
	(%)	(%)	(%)	(%)	(%)
I should eat nuts on most days of a week because nuts are filling I should eat nuts on most days of a week because nuts are a good source of omega-3 fat					

Objective 3. Evaluate perceived benefits and barriers to eating nuts. Benefits and barriers of nut intake were evaluated with 17 statements, eight benefit and nine barrier questions. The statements were scored on a Likert scale rated 1-strongly agree, 2-agree, 3-neither, 4-disagree, and 5-strongly disagree and the distribution was calculated.

Table 6. Distribution of statements concerning benefits and barriers to eating nuts on most days of a week

Benefits and barrier statements	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
	(%)	(%)	(%)	(%)	(%)
Benefits Eating nuts on most day of a week would help me feel better Eating nuts on most days of a week would help me to take better care of my body Eating nuts on most days of a week would help me get more nutrients Eating nuts on most days of a week would help me be healthier Eating nuts on most days of a week would give me the energy I need					

Benefits and barrier statements	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree
	(%)	(%)	(%)	(%)	(%)
Eating nuts on most days of a week would help me to eat more fiber					
Eating nuts on most days of a week would help me to look young					
Eating nuts on most days of a week would be consistent with the advice of my doctor					
Barriers					
Eating nuts on most days of a week would cost me too much money					
Eating nuts on most days of a week would cause me to eat too much fat					
Eating nuts on most days of a week would cause me to eat too many calories					
I would eat nuts on most days of a week if they were available in grocery stores where I go shopping					
I would eat nuts on most days of a week if they were affordable					
I would eat nuts on most days of a week if they had more flavor					
I would eat nuts on most days of a week if they were lower in fat					
I would eat nuts on most days of a week if they were lower in calories					
I would eat nuts on most days of a week if my doctor recommended me to do so					

Objective 4. Assess knowledge regarding the nutrient content of nuts. Knowledge of participants was assessed with five multiple-choice questions with the choice of four to eight answers. The percentage correct for each question was calculated.

Table 7. Percentage of correctly answered knowledge questions related to the nutrient content of nuts

Knowledge Questions	Correct Answers (%)
Nuts such as almonds, pecans, macadamia nuts, cashews and/or hazelnuts contain mainly which of the following type of fat? Walnuts contain mainly which of the following fat? Peanuts and walnuts are considered a good source of which of the following fats? Which of the following nuts have the highest content of omega-3 fatty acids? Which of the following nuts have the highest content of selenium?	

Objective 5. Estimate the consumption of nuts in individuals with or at risk for CVD and/or diabetes. Individuals were given five choices to estimate their nut intake; never, less than once a month, 1-2 times a month, once a week, and 1-2 times a week and the distribution was calculated.

Survey

A survey was adopted and modified from Pawlak and colleagues (2009). A registered dietitian, Mary Gaskins, who works with CVD and respiratory patients at the Cardiovascular and Pulmonary Rehabilitation and The Heart Failure Clinic at HealthSteps, reviewed the survey and modifications were made based her comments to adjust the reading level of the survey. For example, the phrase “predominant fats” was changed to “mainly contains which of the following type of fat” to keep wording as simplistic as possible. The survey included demographic

information, health information, estimated nut consumption, and assessed the beliefs, perceptions, and knowledge of the health effects of frequent nut consumption.

The demographic data on the survey included: age, gender, ethnicity, weight, height, annual income level, and education level. The health information on the survey included previously diagnosed diseases and age of diagnosis. The survey included nine belief statements with three possible answers; true/agree, false/disagree and I don't know. The barriers and benefits of nut intake were evaluated using nine barrier and eight benefit statements that were scored on a Likert scale rated 1-strongly agree, 2-agree, 3-neither, 4-disagree, and 5-strongly disagree. The Likert scale was also used for the 10 attitudinal statements, five positive and five negative. Five knowledge questions were asked with four or eight answers to choose from. Lastly, four questions regarding nut consumption were asked with five to eight options to choose from.

Survey Validation

The adopted and modified survey included nine belief (Cronbach's Alpha = 0.742), five negative attitude (Cronbach's Alpha = 0.823), five positive attitude (Cronbach's Alpha = 0.848), eight benefit (Cronbach's Alpha = 0854), and nine barrier (Cronbach's Alpha = 0.703) statements about the health benefits and nutrient content regarding nut intake. A reliability analysis of the knowledge variables was not conducted because each knowledge statement was treated as a separate measure of awareness of participants rather than collectively as a variable score. The attitude, benefit, and barrier statements were scored on a Likert scale rated 1-strongly agree, 2-agree, 3-neither, 4-disagree, and 5-strongly disagree. The belief statements could be answered as true/agree, false/disagree, or I don't know and the knowledge multiple choice questions contained four to eight answers to choose from.

Participants

A total of 100 respondents initially participated. However, only 85 participants met the inclusion criteria, which included Caucasian or African American ethnicity and greater than 40 years of age. The participants were purposively collected from the East Carolina Heart Institute and the Cardiovascular and Pulmonary Rehabilitation and The Heart Failure Clinic at HealthSteps in Greenville, North Carolina.

Statistical Analysis

The percentage of true/agree, false/disagree, and I don't know was calculated for the belief variables and the percentage answers on a 5-point Likert scale were calculated for the benefits, barriers, and attitude variables. The percent correct was calculated for the knowledge questions and the distribution was calculated for various ways to consume nuts. SPSS statistical software, 18th edition (SPSS, Inc., Chicago, IL 2008) was used for all data analysis.

Data Collection

From May 2011 to August 2011, surveys were administered to assess the beliefs, perceptions, and knowledge of the health benefits and nutrient content regarding nut consumption. The study was approved the by the University and Medical Center Institutional Review Board at East Carolina University. A consent form was read aloud and attached to each survey. Participants were kept anonymous and were asked not to sign or print their name on the survey or consent form. By filling out the survey, participants indicated they agreed to participate in the study. It was clear that participation was voluntary and questions may be left unanswered. The survey was distributed by William Bogey MD, RTV, FACS at East Carolina Heart Institute; and by a Mary Gaskins MS, RD, LDN at Cardiovascular and Pulmonary Rehabilitation and The Heart Failure Clinic at HealthSteps.

CHAPTER 3: RESULTS

Survey Results

A total of 100 surveys were collected from the East Carolina Heart Institute and the Cardiovascular and Pulmonary Rehabilitation and The Heart Failure Clinic at HealthSteps in Greenville, North Carolina. Fifteen of these surveys were excluded because they did not meet the inclusion criteria. Therefore, 85 surveys (85%) remained and were included in the analysis.

Demographics

The mean age of the 85 participants was 63 years and ranged from 41 to 89 years. Participants' gender was almost evenly distributed, 51.8% males and 48.2% females. The majority of the participants were Caucasian (77.6%), while the remaining 22.4% were African American. The mean BMI of the participants was 30.3. Table 8 contains characteristics of the participants.

Table 8. Study characteristics of participants

Socio-demographic characteristics	N	%	Valid (%)
Age			
Mean	63		
BMI			
Mean	30.4		
Missing	4		
Gender			
Males	44	51.8	51.8
Females	41	48.2	48.2
Ethnic Background			
African American	19	22.4	22.4
Caucasian	66	77.6	77.6

Socio-demographic characteristics	N	%	Valid (%)
Annual Household Income			
<10,000	6	7.1	8.0
10,000-20,000	8	9.4	10.7
20,001-35,000	11	12.9	14.7
35,001-50,000	15	17.6	20.0
50,001-65,000	10	11.8	13.3
65,001-85,000	12	14.1	16.0
>85,000	13	15.3	17.3
Missing	10	11.8	-
Highest Attained Education Level			
Less than high school	10	11.8	11.8
Graduated from high school or completed the GED	21	24.7	24.7
Some college	24	28.2	28.2
Graduated college	30	35.3	35.3

Disease Diagnosis or Risk Factors

Out of the 85 participants, 83.6% indicated they were previously diagnosed with at least one of the following: heart disease, heart attack, angina, stroke, hypertension, high cholesterol, or diabetes. Out of these participants, 47.1% indicated they were previously diagnosed with heart disease, 27.1% had a heart attack, 11.8% with angina, 15.3% had a stroke, 61.2% with hypertension, 56.5% with high cholesterol, and 34.1% with diabetes. Additional data can be reviewed in Table 9. The majority of these respondents were Caucasian (76.1%) and males (67.4%). Additionally, 54.2% of participants were diagnosed with at least one type of CVD (heart disease, heart attack, angina, and stroke), 30.6% with at least two types, 14.1% with at least three types, and 2.4% with all four types of CVD. All the participants diagnosed with some type of CVD received their diagnosis between 50 and 60 years of age.

Table 9. Percentage of participants previously diagnosed with CVD and/or diabetes

Disease	Yes (%)	No (%)	I Don't Know (%)	Missing (%)
Heart Disease	47.1	35.3	0	17.6
Heart Attack	27.1	44.7	1.2	27.1
Angina	11.8	52.9	1.2	34.1
Stroke	15.3	47.1	1.2	36.5
Hypertension	61.2	21.2	1.2	16.5
High Cholesterol	56.5	25.9	1.2	16.5
Diabetes	34.1	40.0	0	25.9

Beliefs

As shown in Table 10, about two-thirds of the participants believed that nuts were high in calories (64.7%), fat (68.2%), and dietary fiber (69.4%). About 32% were unaware of the hypocholesterolemic effects of nuts and an additional 21% disagreed that nuts exhibit such effects. Slightly more than one-third of respondents were unaware that frequent nut intake decreases the risk for heart attacks (38.8%) and about 17% disagreed that nuts could perform these effects. Nearly 44% of the participants thought nuts were high in salt, while 10% were unsure of the salt content of nuts. Approximately 42% of the respondents were uninformed of the beneficial effects tree nuts and peanuts have on diabetes. The majority (51.8%) was not aware that the FDA had approved a health claim indicating that the daily consumption of nuts would help lower cholesterol levels and prevent heart disease.

Table 10. Percentage of beliefs concerning nutrient content and health benefits of nuts

Statements	True/ Agree (%)	False/ Disagree (%)	I Don't Know (%)	Missing (%)
Nuts are high in calories	64.7	21.2	12.9	1.2
Nuts are high in fat	68.2	20.0	10.6	1.2
Nuts are high in dietary fiber	69.4	5.9	22.4	2.4
Nuts are high in salt	43.5	43.5	10.6	2.4
Eating nuts may help to lower cholesterol level	41.2	21.2	32.9	4.7
Eating nuts may help to lower a risk for a heart attack	41.2	17.6	38.8	2.4
Eating nuts may help to lower a risk for diabetes	34.1	20.0	42.4	3.5
Eating nuts will cause weight gain	34.1	52.9	10.6	2.4
The U.S. Food and Drug Administration approved a health claim to say that eating nuts daily/on most days may lower cholesterol and prevent heart disease	40.0	5.9	51.8	2.4

Attitudes

At least one-third of the participants strongly disagreed with all five negative attitudinal statements. As seen in Table 11, about one-third of the participants strongly agreed, agreed, or neither agreed nor disagreed with the statement, "*I should not eat nuts on most days of the week because I would gain weight."* At least half of the participants strongly agreed or agreed with all five positive attitudinal statements. One-third of participants neither agreed nor disagreed with the statements, "*I should eat nuts on most days of a week because nuts are filling"* and *"I should eat nuts on most days of a week because nuts are a good source of omega-3 fat"* (28.2% and 38.8%, respectively).

Table 11. Distribution of statements concerning attitudes towards eating nuts on most days of a week

Positive/negative attitude statements	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree	Missing
	(%)	(%)	(%)	(%)	(%)	(%)
Negative attitude						
I should not eat nuts on most days of a week because they are high in fat	8.2	11.8	23.5	21.2	35.3	-
I should not eat nuts on most days of a week because they are high in salt	8.2	15.3	23.5	21.2	31.8	-
I should not eat nuts on most days of a week because they would cause my cholesterol to increase	5.9	10.6	28.2	23.5	30.6	1.2
I should not eat nuts on most days of a week because I would gain weight	4.7	12.9	16.5	36.5	29.4	-
I should not eat nuts on most days of a week because nuts cause allergies	7.1	4.7	21.2	20.0	47.1	-
Positive attitude						
I should eat nuts on most days of a week because nuts are healthy	48.2	23.5	12.9	7.1	7.1	1.2
I should eat nuts on most days of a week because nuts are high in nutrients	47.1	25.9	15.3	5.9	2.4	3.5

Positive/negative attitude statements	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree	Missing
	(%)	(%)	(%)	(%)	(%)	(%)
I should eat nuts on most days of a week because nuts are high in protein	48.2	29.4	10.6	4.7	3.5	3.5
I should eat nuts on most days of a week because nuts are filling	22.4	25.9	28.2	10.6	10.6	2.4
I should eat nuts on most days of a week because nuts are a good source of omega-3 fat	28.2	22.4	38.8	3.5	2.4	4.7

Benefits & Barriers

The majority of participants neither agreed nor disagreed with the 17 benefit and barrier statements. About 54% of participants strongly agreed or agreed with the benefit statement *"Eating nuts on most days of a week would help me to eat more fiber."* The majority (~53%) of participants strongly disagreed or disagreed with the barrier statement, "*Eating nuts on most days of a week would cause me to eat too much fat"* and *"Eating nuts on most days of a week would cause me to eat too many calories."* Approximately, 63.5% of participants indicated they strongly agreed or agreed with the statement, "*I would eat nuts on most days of a week if my doctor recommended me to do so."* Further results can be seen in Table 12.

Table 12. Distribution of statements concerning benefits and barriers to eating nuts on most days of a week

Benefits and barrier statements	1 Strongly Agree (%)	2 Agree (%)	3 Neither (%)	4 Disagree (%)	5 Strongly Disagree (%)	Missing (%)
Benefits						
Eating nuts on most day of a week would help me feel better	12.9	16.5	47.1	12.9	9.4	1.2
Eating nuts on most days of a week would help me to take better care of my body	20.0	23.5	36.5	9.4	9.4	1.2
Eating nuts on most days of a week would help me get more nutrients	24.7	29.4	30.6	8.2	4.7	2.4
Eating nuts on most days of a week would help me be healthier	25.9	27.1	32.0	7.1	5.9	1.2
Eating nuts on most days of a week would give me the energy I need	14.1	29.4	40.0	7.1	5.9	3.5
Eating nuts on most days of a week would help me to eat more fiber	29.4	27.1	29.4	7.1	3.5	3.6
Eating nuts on most days of a week would help me to look young	2.4	9.4	25.9	37.6	23.5	1.2
Eating nuts on most days of a week would be consistent with the advice of my doctor	15.3	11.8	42.4	12.9	15.3	2.4

Benefits and barrier statements	1 Strongly Agree	2 Agree	3 Neither	4 Disagree	5 Strongly Disagree	Missing
	(%)	(%)	(%)	(%)	(%)	(%)
Barriers						
Eating nuts on most days of a week would cost me too much money	8.2	16.5	27.1	23.5	23.5	1.2
Eating nuts on most days of a week would cause me to eat too much fat	12.9	11.8	20.0	30.6	22.4	2.4
Eating nuts on most days of a week would cause me to eat too many calories	20.0	12.9	17.6	25.9	20.0	3.5
I would eat nuts on most days of a week if they were available in grocery stores where I go shopping	17.6	10.6	29.4	16.5	22.4	3.5
I would eat nuts on most days of a week if they were affordable	23.5	20.0	27.1	9.4	17.6	2.4
I would eat nuts on most days of a week if they had more flavor	8.2	7.1	27.1	27.1	25.9	4.7
I would eat nuts on most days of a week if they were lower in fat	22.4	11.8	23.5	17.6	21.2	3.5
I would eat nuts on most days of a week if they were lower in calories	25.9	11.8	27.1	14.1	18.8	2.4
I would eat nuts on most days of a week if my doctor recommended me to do so	43.5	20.0	22.4	2.4	9.4	2.4

Knowledge

An average of 61% of participants answered the knowledge questions concerning the nutrient content of tree nut and peanuts incorrectly. *"Peanuts and walnuts are considered a good source of which of the following fats?"* was the only exception; 65.9% answered correctly. Table 13 indicates the percent answered correctly by participants for all five knowledge questions.

Table 13. Percentage of correctly answered knowledge questions related to the nutrient content of nuts

Knowledge Questions	Correct Answers (%)	Missing (%)
Nuts such as almonds, pecans, macadamia nuts, cashews and/or hazelnuts contain mainly which of the following type of fat?	14.1	8.2
Walnuts contain mainly which of the following fat?	5.9	8.2
Peanuts and walnuts are considered a good source of which of the following fats?	65.9	12.9
Which of the following nuts have the highest content of omega-3 fatty acids?	25.9	10.6
Which of the following nuts have the highest content of selenium?	22.4	20.0

Nut Consumption

Slightly more than half the participants believed they consumed a healthy diet (56.5%). However, only 35.3% indicated they ate nuts 1-2 times a week, as shown in Table 14. Table 15 shows that participants were more likely to consume salted nuts (55.3%) or roasted nuts (74.1%). Most individuals preferred peanuts, almonds, cashews, or pecans (72.9, 45.9, 42.4, 60.0; respectively).

Table 14. Percentage of nut intake

Nut Intake	Answer (%)
Never	5.9
Less than once a month	16.5
1-2 times a month	22.4
Once a week	18.8
1-2 times a week	35.3
Missing	1.2

Table 15. Percentages related to nut consumption

Nut Consumption	Yes (%)	No (%)	Missing (%)
I typically eat raw nuts	34.1	64.7	1.2
I typically eat salted nuts	55.3	43.5	1.2
I typically eat roasted nuts	74.1	24.7	1.2
I typically eat nuts as nut butter	17.6	81.2	1.2
I typically eat none of the above	3.5	95.3	1.2
I would most likely eat raw nuts	22.4	76.5	1.2
I would most likely eat salted nuts	41.2	57.6	1.2
I would most likely eat roasted nuts	63.5	35.3	1.2
I would most likely eat nuts as nut butter	14.1	84.7	1.2
I would most likely not eat any of the above	2.4	96.5	1.2
I consume peanuts more often	72.9	25.9	1.2
I consume almonds more often	45.9	52.9	1.2
I consume cashews more often	42.4	56.5	1.2
I consume pine nuts more often	3.5	95.3	1.2
I consume Brazil nuts more often	9.4	89.4	1.2
I consume macadamia nuts more often	8.2	90.6	1.2
I consume hazelnuts more often	4.7	94.1	1.2
I consume pecans more often	60.0	38.8	1.2

Nut Consumption	Yes (%)	No (%)	Missing (%)
I consume walnuts more often	36.5	62.4	1.2
I consume pistachios more often	24.7	74.1	1.2

CHAPTER 4: DISCUSSION

A number of studies have shown that frequent nut intake can decrease the risk of chronic disease development, such as CVD or diabetes, in comparison to those with infrequent or no nut intake (Fraser et al., 1992; Kushi et al., 1996; Hu et al., 1998; Kelly & Sabaté, 2006; Albert et al., 2002; Djoussé et al., 2008; Djoussé et al., 2009; Jiang et al., 2002; Villegas et al., 2008; Chisholm et al., 2005; Banel & Hu, 2009; Griel et al., 2008; Gebauer et al., 2008; Sabaté et al., 2010; Rajaram et al., 2010; Jiang et al., 2006; Mantzoro et al., 2006). Men as young as 35 to 44 years of age and women in their mid fifties are at an increased risk for developing CVD (Rogers et al., 2011). These individuals also have a greater chance of developing diabetes. Therefore, it would be important that they not only be aware of the benefits associated with nut intake, but also understand the significance for following the recommendations for nut consumption. Unfortunately, no studies have been conducted to date that assessed individuals' beliefs, perceptions (e.g. attitudes, perceived barriers and benefits), knowledge, and nut consumption among people with or at risk for developing these health conditions. Thus, the goal of this study was to fill this gap. Specifically, this research attempted to: 1) assess the salient beliefs, 2) measure positive and negative attitudes, 3) evaluate perceived benefits and barriers, and 4) assess knowledge, regarding the nutrient content and heath benefits associated with nut intake in individuals with or at risk for developing CVD and/or diabetes. Additionally, nut consumption was assessed.

The current research revealed that the awareness of the nutritional content and health benefits of frequent nut consumption among the study sample, for the most part, was inadequate. Other studies have found similar results. For instance, two-thirds of WIC participants did not believe nuts had hypocholesterolemic effects and only slightly more than one-third were aware

that nuts do not influence weight gain (Pawlak, Colby, & Herring, 2009). A study conducted by Pawlak and colleagues (2009) found very similar results to the results of the current study when evaluating the beliefs, benefits, barriers, attitudes, and knowledge of nut consumption in a population of WIC participants. Contrary results were reported in another study conducted by Pawlak (2009) that included registered dietitians. In fact, the majority of the dietitians were aware of the hypocholesterolemic effects of nuts (Pawlak, 2009). Pawlak (2009) found adequate beliefs, perceptions, and knowledge regarding the beneficial health effects and nutritional content of nuts among dietitians.

The current research indicated that approximately, one-third of the participants were unaware that nuts could lower cholesterol levels and 21% believed they did not exhibit these effects. Similar results were seen in individuals previously diagnosed with CVD. This belief is inconsistent with recent studies; a meta-analysis conducted with Banel and Hu (2009) indicated that nut consumption does in fact lower blood lipid profiles. About 40% of respondents were unaware and about 20% did not believe that nut consumption is beneficial in terms of prevention of diabetes and heart attacks. Among the 29 individuals previously diagnosed with diabetes, 37.9% were also unaware and 10.3% did not believe that frequent nut intake could help decrease the risk of developing diabetes. Also, out of the 46 individuals previously diagnosed with CVD, 41.3% were unaware and 13% did not think that nuts have beneficial effects on heart attack risk. Individuals previously diagnosed with these health conditions seem to be more aware of the benefits of frequent nut consumption.

About one-third of the participants strongly agreed, agreed or neither agreed nor disagreed with the negative attitudinal statement, "*I should not eat nuts on most days of the week because I would gain weight."* According to the Djoussé, Rudich, and Gaziano (2008)

participants who consumed nuts had lower weights in comparison to those with no nut intake. More individuals previously diagnosed with diabetes (44.8%) indicated they would eat nuts most days of the week if nuts contained lower amounts of fat in comparison to the entire study sample (34.2%). Higher BMIs and obesity status are risk factors for CVD and diabetes. The results of this research study indicate that about one-third of participants in the current study were largely unaware of or held an incorrect belief about the impact of nuts on weight. Such an incorrect belief could be a barrier for nut consumption for these individuals.

Interestingly, 65.9% of participants knew that peanuts and walnuts were a good source of omega-3 fatty acids and half of the participant either strongly agreed or agreed with the attitudinal statement, *"I should eat nuts on most days of a week because nuts are a good source of omega-3 fat."* This could explain why the intake of peanuts was higher than the intake of other nuts. However, it would not explain relatively low intake of walnuts. Thus, it is also possible that the relatively high intake of peanuts is a result of the popularity of peanut products such as peanut butter, irrespective of any health-related or nutritional content of peanuts. Also, relatively low intake of walnuts could also be due to other barriers mentioned below. The percentage of participants previously diagnosed with some type of CVD and/or diabetes rated the positive and negative attitudinal statements in a similar way, with the exception of the statement related to high fat content.

About one-third of the participants answered neither agreed nor disagreed for many of the benefits questions, indicating that they are not aware of such benefits. Participants previously diagnosed with CVD also answered these statements similarly. However, the awareness of the association of nuts intake on lower diabetes risk was higher among individuals previously diagnosed with diabetes than those who were not diagnosed with this disease (48% vs. 34%).

This indicates that individuals previously diagnosed with diabetes may be more aware of the benefits of nuts in diabetes prevention.

Nut consumption among participants was relatively low. Many individuals were aware of the high fat and calorie content in nuts, yet they were unaware of the beneficial impact these nutrients have on CVD and diabetes. People are often cautious about calorie and fat intake, which could explain the low intake of nuts. On the other hand, studies have shown that the fiber content in nuts decreases the risk of developing CVD and diabetes (Sabaté & Ang, 2009). Thus, one possible way to increase intake of nuts is to educate the public regarding the fiber content found in nuts.

Only 27% of participants strongly agreed or agreed that their doctors advise them to eat nuts on most days of the week. While the majority of participants strongly agreed or agreed that they would consume nuts on most days of the week if the doctor recommended them to do so. Higher proportion of participants with diabetes (65.5%) strongly agreed or agreed that they would consume nuts if recommended to do so by their doctor. St. Michael's Hospital and the University of Toronto conducted a study on the effects of doctor's dietary advice on lowering cholesterol levels. Participants given doctor's advice had lowered cholesterol levels by about 13%; while participants who did not receive advice only decreased cholesterol levels by 3%. Doctor's dietary advice may be an effective, way to improve the health of individuals (Patients listens when doctors give dietary advice, 2011). Our study confirms this suggestion, since almost two/thirds indicated that they would follow such advice. However, it is unclear the extent of awareness among physicians regarding the effects of nuts on CVD and diabetes. Future studies are needed to assess physician awareness and recommendation practices.

Aside from doctor's recommendation, nut affordability was the largest barrier indicated among the entire sample. Slightly less than half of the participants indicated the affordability of nuts and about one-third implied that the nutrient content (calories and fat) of nuts were a barrier of nut consumption. Individuals diagnosed with diabetes strongly agreed or agreed they would eat nuts if they were available in the grocery stores where they shopped (37.9%) in comparison to the study sample (28.2). Individuals who were previously diagnosed with diabetes indicated flavor and fat content as a barrier to nut consumption (24.1% and 44.8%, respectively).

Participants' level of knowledge regarding nutrient content of nuts was very low, an average of 61% of participants answered incorrect responses. Only about one-eighth of the participants were aware of the predominant fat, MUFA, found in nuts and about one-fifth were aware of the selenium content in Brazil nuts. About 68% of respondents reported they believed nuts were high in fat, and 56% believed they should not consume nuts due to this high content. However, nuts contain very beneficial types of fat, such as MUFA and PUFA, and are low in SFA (Chisholm, McAuley, Mann, Williams, & Skeaff, 2005; Ros 2010). A higher volume of nuts consumption with beneficial MUFA and PUFA could replace those foods that are high in SFA (Griel et al., 2008). An increased consumption of these beneficial fats in comparison to non-beneficial fats is in compliance to the 2010 Dietary Guidelines for Americans (Dietary guidelines for Americans 2010, 2010).

Individuals previously diagnosed with one or more types of CVD, also incorrectly answered all the questions, an average of 61% of individuals with incorrect responses. Individuals previously diagnosed with diabetes indicated they had a slightly higher correct response percentage relating to the nutrient content of nuts in comparison to the study sample, averaging 55% of participants answered incorrectly. This indicates that participants may not be

aware of the beneficial nutrients found in nuts and could explain the relatively low nut intake. However, individuals diagnosed with diabetes may have received some nutrition education.

Only about one-third of the participants indicated they consume nuts 1-2 times a week. The majority of participants' intake was less frequent. Thus, the majority of the participants failed to have an intake of nuts that reflects the current recommendation of 1.5 ounces on most days of the week. At the same time, a little over half of the participant believed they consumed a healthy diet. Beliefs regarding doctors' advice/recommendations, affordability and fat and calorie content may play a significant role in low nut intake within this population. Education and advice from doctors and other healthcare professionals communicating the current scientific evidence, regarding the health benefits of frequent nut intake on CVD and diabetes, could help increase nut consumption and awareness.

This is the only study to date, to assess beliefs, perceptions (e.g. attitudes, perceived barriers and benefits), knowledge, and nut consumption among people at risk for developing CVD and/or diabetes. It is important for individuals over the age of 40 to be aware of the benefits nuts have on health conditions, since they are at greater risk for developing CVD and/or diabetes (Rogers et al., 2011). Unfortunately, this study provides evidence that scientific knowledge on the health benefits of frequent nut consumption is not being communicated to individuals over the age of 40. Pawlak, Colby, and Herring (2009) found that WIC participants are also largely unaware of current scientific findings regarding the health benefits due to frequent nut consumption. Only three studies have been conducted on the beliefs, perceptions and knowledge on the beneficial health impact of nut consumption, including the current study. More studies are needed to determine the best way to address the gaps in awareness of individuals regarding nutrient profile and health effect of nuts intake.

Study Limitations

There were two major limitations to the current research. Only 85 participants were included in this study, creating a small sample size, and only Caucasian and African American ethnicities were included in the sample. Additional studies need to be conducted to assess the most important factors influencing the intake of nuts in both the general public and people at risk for chronic health conditions. Also studies on the best way to relay current scientific evidence to individuals and an evaluation of beliefs, perceptions, knowledge, and nut consumption differences between different health conditions need to be conducted.

Conclusion

Individuals over the age of 40 years are at an increased risk for developing CVD and/or diabetes (Rogers et al., 2011). CVD and diabetes are among the leading causes of death in the United States. Studies have shown that frequent nut consumption has an inverse association with CVD and diabetes incidences and mortalities. This scientific evidence needs to be expressed more thoroughly to individuals over the age of 40 with or at risk for these health conditions. Many individuals were not aware that nuts could help lower the risk for a heart attack or diabetes and one-third believed nuts caused weight gain. Beliefs and perceptions (attitudes, perceived barriers and benefits) were inadequate, while knowledge levels were very low regarding the health benefits and nutrient content of nut intake. Individuals seek doctors for advice; therefore doctors play a key role in informing individuals of the health benefits regarding frequent nut intake (Patients listens when doctors give dietary advice, 2011). Informing individuals over the age of 40 years, with or at risk for developing CVD and/or diabetes, about the health benefits of nut consumption may decrease CVD and/or diabetes incidences and mortalities.

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APPENDIX A: IRB APPROVAL FORM

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
1L-09 Brody Medical Sciences Building• 600 Moye Boulevard • Greenville, NC 27834
Office **252-744-2914** • Fax **252-744-2284** • **www.ecu.edu/irb**

Date: March 9, 2011

Principal Investigator: Hilary London
Dept./Ctr./Institute: College of Human Ecology
Mailstop or Address: 2201 Bellamy Circle, Apt. 115, Greenville, NC 27858

RE: **Exempt Certification** VCK
UMCIRB# **11-0162**
Funding Source: Unfunded

Title: "Perception Knowledge and Beliefs in Cardiovascular Patients Regarding the Benefits of Nut Intake."

Dear Ms. London:

On 3.8.11, the University & Medical Center Institutional Review Board (UMCIRB) determined that your research meets ECU requirements and federal exemption criterion #2 which includes research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects and any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

It is your responsibility to ensure that this research is conducted in the manner reported in your Internal Processing Form and Protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The UMCIRB Office will hold your exemption application for a period of five years from the date of this letter. If you wish to continue this protocol beyond this period, you will need to submit an Exemption Certification Request at least 30 days before the end of the five year period.

Sincerely,

Chairperson, University & Medical Center Institutional Review Board

Pc: Dr. Roman Pawlak

APPENDIX B: PERMISSION LETTERS

From: Morris, Kimberly [MORRISK@ecu.edu]

Sent: Monday, January 24, 2011 9:58 AM

To: London, Hilary Anne

Subject: Thesis data from the Heart Institute

Hilary:
I am so sorry this has taken a while - I didn't know the process was going to be so complicated; however, I have just found out the information below;
FYI: Dr. Bogey has agreed to do this and the below is needed before you can start
if you have any more questions, please call me @ 744-1207 or email: morrisk@ecu.edu

Thanks
Kim

February 14, 2010

To whom it may concern,

I am happy to support Hilary London work toward the completion of her thesis here at HealthSteps. She will be allowed to administer a survey to cardiovascular patients at HealthSteps and I will assist her as needed.

Mary Tayloe Gaskins, MS, RD, LDN
Clinical Dietitian III
HealthSteps, Cardiovascular and Pulmonary Rehabilitation Program and
The Heart Failure Clinic at HealthSteps
P.O. Box 6028
Greenville, NC 27835-6028
252-847-8774
252-847-7337 (fax)
mgaskins@pcmh.com

APPENDIX C: CONSENT FORM & SURVEY

March 3, 2011

Hello,

You are invited to take a part in a research study about perception, knowledge and beliefs on nut intake. If you agree to take part in this study you will agree to complete a survey administered to you by a health care professional/employee at your facility. The goal of this research is to find out consumers' perception of eating nuts. Your participation is ABSOLUTELY voluntary and you may drop out or refuse to complete the survey at any time. There is virtually no risk of any kind to you as a participant. All collected data will be kept in a locked office and will not be used to discriminate against you or to cause you or anyone any harm. Collected data may be used in publications in professional journals; however, your name will never be used in any form in any reports based on this study. In fact, the survey you will be asked to complete is anonymous and thus, you will be asked not to sign or print your name on the survey. By completing the attached survey you indicate that you agree to participate in this study.

Please note that this research has been approved by the Institutional Review Board at East Carolina University, which ensures that the rights of study participants are respected at all times. If you have any questions about this survey, the research project or your role as a participant, or if you have any other questions or concerns, please contact me at the address given below or speak to the health care professional/employee at the site.

We sincerely appreciate your willingness to take part in this study.

Regards,

Hilary London,
Principal Investigator
Graduate Student
Department of Nutrition and Dietetics
East Carolina University
207-943-3121

Roman Pawlak, Ph. D
Associate Professor
East Carolina University
Ph.: 252-328-2350

Nuts can be defined as seeds of some plants covered by hard, woody shell. Nuts are usually divided into two categories: tree nuts and peanuts. Tree nuts include almonds, Brazil nuts, cashews, chestnuts, coconuts, hazelnuts, macadamia nuts, pecans, pistachios and walnuts. Please answer each of the following questions about your perception of the health effects and nutrient content of nuts.

I. Please circle the appropriate number that corresponds with your degree of agreement for each statement.

		Agree				Disagree
		1	2	3	4	5
1	I should not eat nuts on most days of a week because they are high in fat	1	2	3	4	5
2	I should not eat nuts on most days of a week because they are high in salt	1	2	3	4	5
3	I should not eat nuts on most days of a week because they would cause my cholesterol to increase	1	2	3	4	5
4	I should not eat nuts on most days of a week because I would gain weight	1	2	3	4	5
5	I should not eat nuts on most days of a week because nuts cause allergies	1	2	3	4	5
6	I should eat nuts on most days of a week because nuts are healthy ……	1	2	3	4	5
7	I should eat nuts on most days of a week because nuts are high in nutrients	1	2	3	4	5
8	I should eat nuts on most days of a week because nuts are high in protein	1	2	3	4	5
9	I should eat nuts on most days of a week because nuts are filling ……..	1	2	3	4	5
10	I should eat nuts on most days of a week because nuts are a good source of omega-3 fat	1	2	3	4	5
11	Eating nuts on most day of a week would help me feel better ……..	1	2	3	4	5
12	Eating nuts on most days of a week would help me to take better care of my body	1	2	3	4	5
13	Eating nuts on most days of a week would help me get more nutrients ….	1	2	3	4	5
14	Eating nuts on most days of a week would help me be healthier …….....	1	2	3	4	5
15	Eating nuts on most days of a week would give me the energy I need …..	1	2	3	4	5
16	Eating nuts on most days of a week would help me to eat more fiber ……	1	2	3	4	5
17	Eating nuts on most days of a week would help me to look young ……	1	2	3	4	5
18	Eating nuts on most days of a week would be consistent with the advice of my doctor	1	2	3	4	5

		Agree				Disagree
		1	2	3	4	5
19	Eating nuts on most days of a week would cost me too much money ……	1	2	3	4	5
20	Eating nuts on most days of a week would cause me to eat too much fat …	1	2	3	4	5
21	Eating nuts on most days of a week would cause me to eat too many calories	1	2	3	4	5
22	I would eat nuts on most days of a week if they were available in grocery stores where I go shopping	1	2	3	4	5
23	I would eat nuts on most days of a week if they were affordable ……..	1	2	3	4	5
24	I would eat nuts on most days of a week if they had more flavor ……...	1	2	3	4	5
25	I would eat nuts on most days of a week if they were lower in fat …….	1	2	3	4	5
26	I would eat nuts on most days of a week if they were lower in calories ….	1	2	3	4	5
27	I would eat nuts on most days of a week if my doctor recommended me to do so	1	2	3	4	5

II. Please place a check "√" in an appropriate column.

		True/ Agree	False/ Disagree	I don't know
1	Nuts are high in calories ……...	□	□	□
2	Nuts are high in fat ……...	□	□	□
3	Nuts are high in dietary fiber ……...	□	□	□
4	Nuts are high in salt …….	□	□	□
5	Eating nuts may help to lower cholesterol level ……..	□	□	□
6	Eating nuts may help to lower a risk for a heart attack ……	□	□	□
7	Eating nuts may help to lower a risk for diabetes ……	□	□	□
8	Eating nuts will cause weight gain ……...	□	□	□
9	The U.S. Food and Drug Administration approved a health claim to say that eating nuts daily/on most days may lower cholesterol and prevent heart disease	□	□	□

III. Please select the answer you believe is correct for each question.

1. Nuts such as almonds, pecans, macadamia nuts, cashews and/or hazelnuts contain mainly which of the following type of fat?

a. Saturated fat

b. Monounsaturated fat

c. Polyunsaturated fat

d. Omega-3 fat

2. Walnuts contain mainly which of the following fat?

a. Saturated fat

b. Monounsaturated fat

c. Polyunsaturated fat

d. I don't know

3. Peanuts and walnuts are considered a good source of which of the following fats?

a. Arachidonic acid

b. Omega-3 fatty acids

c. Omega-6 fatty acids

d. EPA

e. DHA

4. Which of the following nuts have the highest content of omega-3 fatty acids?

a. Almonds b. Brazil nuts

c. Cashews d. Hazelnuts

e. Macadamia nuts f. Pecans

g. Peanut h. Walnuts

5. Which of the following nuts have the highest content of selenium?

a. Almonds b. Brazil nuts

c. Cashews d. Hazelnuts

e. Macadamia nuts f. Pecans

g. Peanut h. Walnuts

IV. Please answer the following questions that deal with the consumption of nuts.

1. Which of the following nuts do you typically eat, if any? *(select all that you eat)*

a. Raw
b. Salted
c. Roasted
d. As nut butter
e. None

2. If you were to eat nuts, which of the following nuts you would most likely eat? *(select one)*

a. Raw
b. Salted
c. Roasted
d. As nut butter
e. None

3. Which of the following nuts do you consume most often? *(select all that you eat)*

□ Peanuts
□ Almonds
□ Cashews
□ Pine Nuts
□ Brazil Nuts
□ Macadamia Nuts
□ Hazelnuts
□ Pecans
□ Walnuts
□ Pistachios

4. How often do you consume nut

□ Never
□ Less than once a month
□ 1-2 times a month
□ Once a week
□ 1-2 times a week

V. Please complete the information found below. This section will only be used to describe the group of people who completed the survey. Your personal characteristics will not be revealed.

1. I am a Male Female

2. I am _____ years old.

3. My height is ___ feet and ___ inches and my weight is _____ lbs.

4. My ethnic background is:

a. African American
b. Hispanic American
c. Asian American
d. Native American
e. Caucasian (White)
f. Other (specify):

5. My annual household income is:

a. Less than 10,000
b. 10,000 -20,000
c. 20,001-35,000
d. 35,001-50,000
e. 50,001-65,000
f. 65,001-85,000
g. 85,000 or more

6. My highest attained level of education is:

a. Less than high school
b. Graduated from high school or completed the GED
c. Some college
d. Graduated from college

7. Do you believe you have a healthy diet?

a. Yes, I have a healthy diet.
b. No, I do not have a healthy diet.

8. Have you ever been diagnosed with any of the following (mark and fill in all that apply)?

Disease	Yes	No	I do not remember/ I do not know	Age Diagnosed
Heart disease	☐	☐	☐	_____
Angina	☐	☐	☐	_____
Hypertension	☐	☐	☐	_____
High cholesterol	☐	☐	☐	_____
Diabetes	☐	☐	☐	_____

Thank you for completing the survey!